



# Greenhouse Gas Emissions: Calculating Reductions and Trading Credits

**Ms. Nancy E. Checklick**  
**Science Applications International  
Corporation (SAIC)**  
**U.S.-Mexico Propane Workshop**  
**November 6 & 7, 2003**  
**Mexico City**



# Presentation Overview

- **Introduction – purpose and possibilities for LPG in transportation**
- **Calculating greenhouse gas emissions and reductions**
- **LPG Manual on GHGs**
- **Case study: Aguyatia Energy in Pucallpa, Peru**
- **International market for trading reductions**



# Introduction: Purpose and Possibilities

## Potential

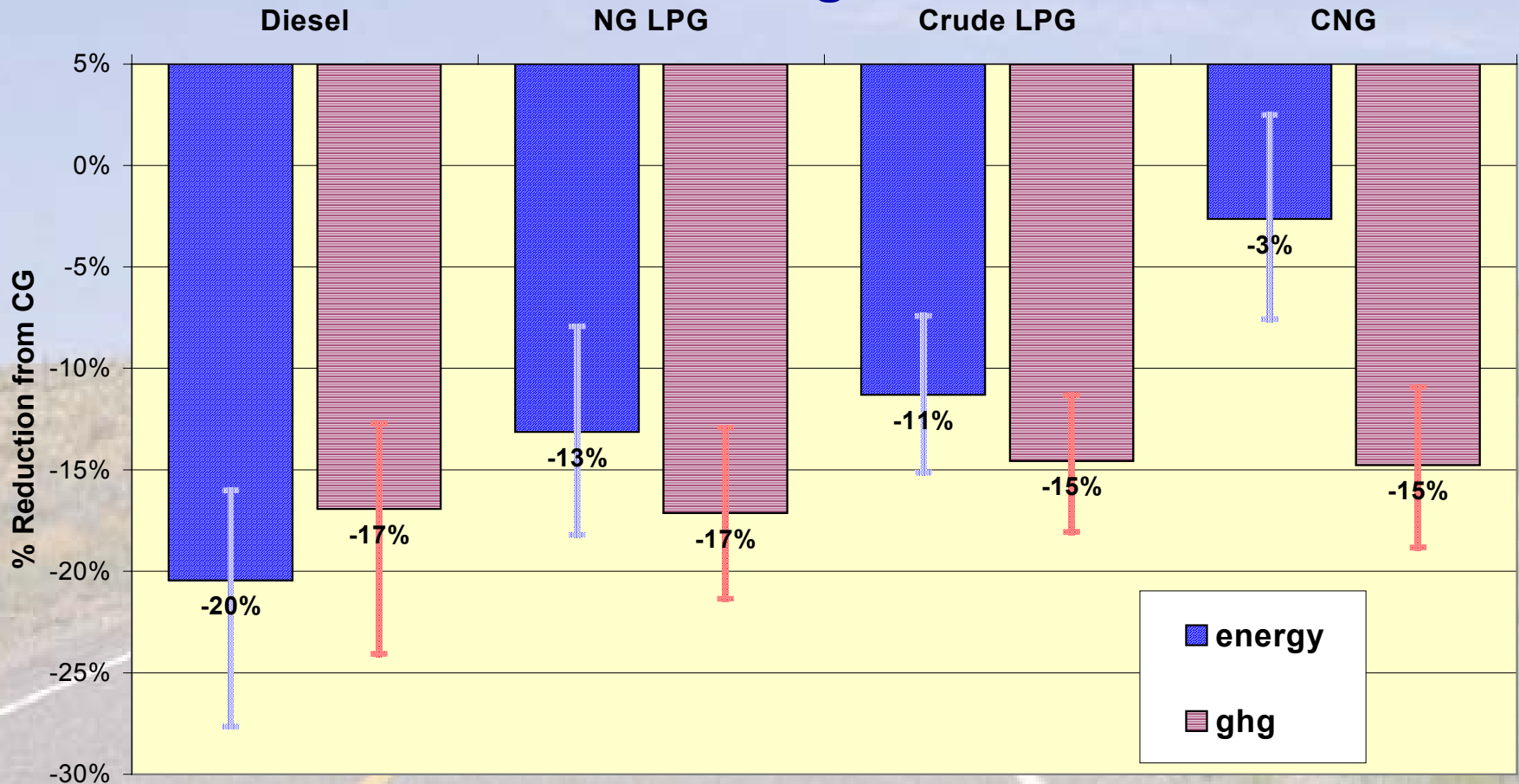
- ***Can Alternative Fuel Vehicle Projects Generate GHG Reduction Offsets and Credits?***
- Transportation accounts for a rapidly growing share of global emissions
- LPG accounts for only a fraction of the global transport fuel market

## Possibilities

- Transportation projects do not easily lend themselves to large scale GHG reduction projects
  - Reductions from individual vehicles are small
- Carbon financing to develop large scale projects
- ***Broaden the GHG market to transportation***

# Benefits of LPG

## Well to Wheel Per-Mile GHG Reductions – percent reduction from conventional gasoline



CG = Conventional Gasoline



# Calculating GHG Emissions and Reductions

- Many different methods and tools to calculate GHGs
- Guidance from international climate experts at the IPCC and UNFCCC
- Helpful tools developed, e.g. computer models
- On behalf of the U.S. National Energy Technology Laboratory (NETL), SAIC has written a series of manuals to guide fleet owners interested in developing GHG projects.
  - Electric and Hybrid Electric Vehicles  
[www.ccities.doe.gov/international/pdfs/hev\\_ev\\_ghgreductions.pdf](http://www.ccities.doe.gov/international/pdfs/hev_ev_ghgreductions.pdf)
  - Natural Gas Vehicles  
[www.netl.doe.gov/products/ccps/pubs/NGV\\_guide.PDF](http://www.netl.doe.gov/products/ccps/pubs/NGV_guide.PDF)
  - **LPG Vehicles! See *cd-rom handed out today***



# Calculating GHG Emissions and Reductions: Manuals

## These manuals

- Introduce readers to GHG reduction quantification
- Introduce readers to the concept of an emissions trading market
- Explain the process of turning a transportation project into a GHG reduction project



# Calculating GHG Reductions – Creating Your Project

## ***Need to answer accounting issues***

- **Would this project have happened anyway in a business-as-usual scenario? ADDITIONALITY**
- **Chose which GHGs to include?**
  - CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O are usual for transport projects
- **Include Upstream (production, refining, transport) along with Tailpipe Emissions?**
- **Which Emission Factors to Use?**
  - IPCC, GREET, etc.
- **What data do you have available for emissions calculations?**
  - Odometer or Fuel Records



# Case Study: Aguyatia Energy in Pucallpa, Peru

## Project:

- Convert 20,000 mototaxis from leaded gasoline to LPG over five years
- Cost share with vehicle owners
  - Conversion costs \$240
  - Developer pays \$180
- Scoping and analysis of GHG potential
- GHG reductions result from:
  - Improved vehicle efficiency
  - Lower carbon intensity

Reduce costs to  
owners  
Typical monthly  
income is \$150/mo  
**Savings: \$20 per month**  
**In fuel**  
**\$20 per month**  
**In motor oil**

**Reduce air &  
water pollution**



# Case Study: Aguyatia Energy in Pucallpa, Peru

- **Aguyatia Energy request analysis for pilot project to convert 20,000 taxis**
- **Would this project have gone forward without carbon financing?**



- Hard to say. The initial phase, involving 1,700 conversions, is already underway, and being used to gain experience and data. But these 1,700 would not be part of the GHG project (the 20,000 to follow would).
- Project conducted by an LPG supplier. Is it simply market development?
- Developer's Claim: it would be cost effective to convert a certain number of vehicles, beyond which additional financing would be required.
- Thus, additionality was phrased in terms of number of vehicles.

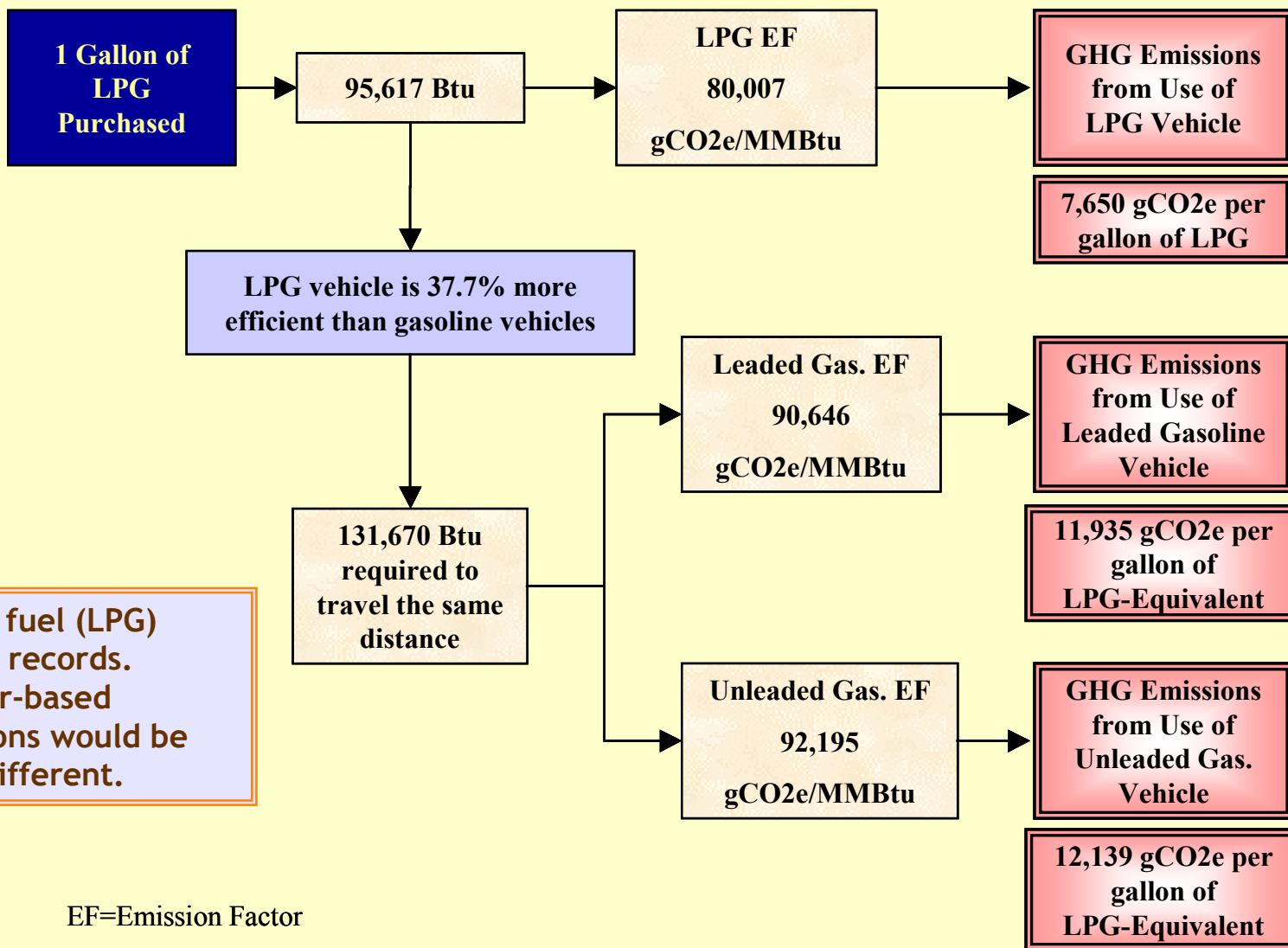
# Case Study: Calculate Emissions

**Because of the low octane and low-grade gasoline currently used in the region, the mototaxis tend to burn rich air/fuel mixtures, and thus consume more fuel.**

Leaded Gasoline Vehicle	Unleaded Gasoline Vehicle	LPG Vehicle
51 MPG	--	57 MPG
432.9 miles/MMBtu	432.9 miles/MMBtu	596.1 miles/MMBtu
--	--	37.7% improvement

**Used IPCC emission factors for tailpipe CO<sub>2</sub> and used correction factors to account for upstream and total GHG emissions.**

# Case Study: Calculate Emissions





# Case Study: Calculate Reductions

- **Develop a baseline of “what would have happened without the project”**
  - Case Study projected several baseline scenarios
- **Use this to compare to what your project will emit to calculation reductions**

**Net GHG Emission Reductions in grams of CO<sub>2</sub>e in year Y =**

**[number of additional vehicles in year Y]**

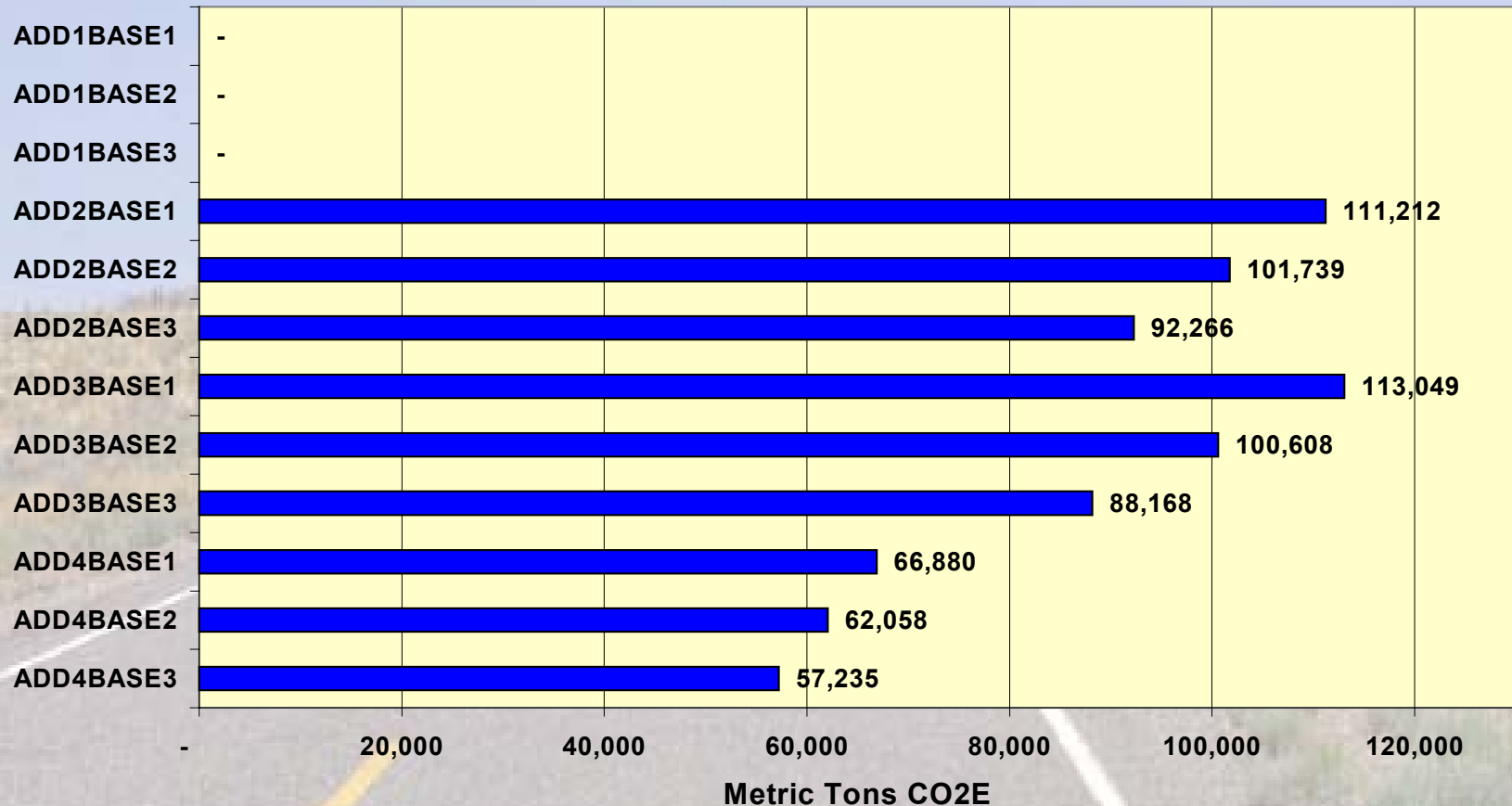
**x [Average Volume of Fuel Used by an LPG Vehicle in year Y]**

**x [Baseline Emissions Factor for year Y – Project Emissions Factor for year Y]**



# Case Study Results: Reductions

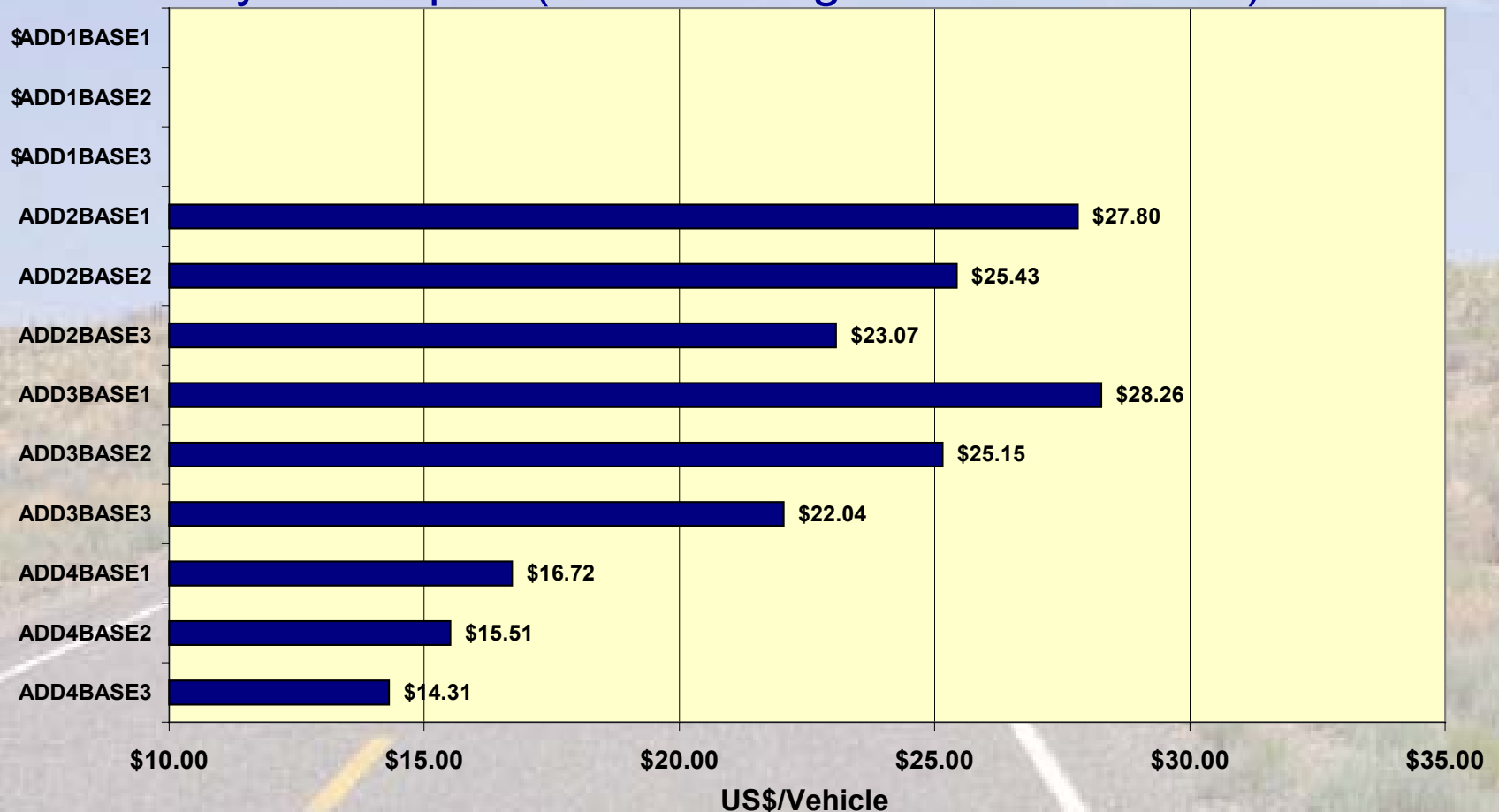
Using multiple additionality and baseline scenarios, reductions range from 57,000 to 111,000 metric tons CO<sub>2</sub>E





# Case Study Results: Carbon Revenue per Vehicle

Assuming \$5/tonne, for all 20k vehicles, over the project lifetime.  
This is 6-12% of total cost of the conversion, and 8-16% of cost borne by developer. (not including transaction costs)



# Case Study Lessons

- **Aguaytia is going ahead with the initial 1,700 conversions, but has not yet developed a proposal for carbon financing for more vehicles.**
- **Project needs to develop more than a minimum number of offsets to be worth the effort.**
- **Aggregation is the key. In this case, with conservative assumptions, 20,000 mototaxis is just beginning to put the project on par with other projects types in terms of total GHG reductions.**
- **There are over 200,000 3-wheeler mototaxis and 650,000 gasoline engines in Peru. If done on a national basis, then critical mass can be reached.**
- **But are the accounting methods acceptable?**





# International Market for Trading Reductions

- 280 GHG transactions worldwide 1996 - Fall 2002, exchanging 190 million metric tons of CO<sub>2</sub>
- Price of verified credits ranged between US\$0.50-\$5.00 per metric ton of CO<sub>2</sub>
- Investors prefer low-risk, credible, and permanent GHG credits
  - Proof of environmental additionality
  - Monitoring and verification plan
  - Certification of legitimate ownership
- One sample transportation project – Approved under UNFCCC Activities Implemented Jointly (AIJ) Pilot Phase
  - RABA/IKARUS CNG bus project (Hungary)  
<http://www.unfccc.int/program/aij/aijproject.html>



# International Market for Trading Reductions

## Opportunities for financing with:

- Andean Development Bank, [www.caf.com](http://www.caf.com)
  - Funded projects for Bogota city road plan, Caracas metro
  - June 2002 signed agreement to purchase GHG w/Netherlands CDM
- Inter-American Development Bank, [www.iadb.org](http://www.iadb.org)
- World Bank Prototype Carbon Fund, [www.prototypecarbonfund.com](http://www.prototypecarbonfund.com)
- Clean Development Mechanism (CDM) – Kyoto Protocol, UNFCCC
  - Developed countries invest in emission reduction projects in developing countries in exchange for emission reduction credits
- Chicago Climate Exchange (CCX), [www.chicagoclimatex.com](http://www.chicagoclimatex.com)
  - A private U.S. GHG exchange. Very new, very secretive in beginning stages.
- Oregon Climate Trust, [www.climatetrust.com](http://www.climatetrust.com)
  - Prefers U.S. projects, but open to international
  - One transport project: carpooling in Portland, Oregon



# Any Questions?

## ***Special Thanks to:***

- Dante LaGatta, Aguaytia Energy
- Jim Ekmann, National Energy Technology Laboratory (NETL)
- Michael Wang, Argonne National Laboratory (ANL)
- Josh Radoff, SAIC
- Rich Bechtold, Independent Consultant

## **Contact:**

**Nancy E. Checklick**

**SAIC**

**8301 Greensboro Dr. M/S E-5-7  
McLean, VA 22102**

**Tel. 703-676-5750**

**Fax 703-676-7514**

**Email: [checklickn@saic.com](mailto:checklickn@saic.com)**